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FARMERS' BULLETIN 550.

CRIMSON CLOVER:

GROWING THE CROP.

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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., June 12, 1913.

SIR: I have the honor to transmit herewith and to recommend for publication as a Farmers' Bulletin the accompanying manuscript entitled "Crimson Clover: Growing the Crop." This has been prepared by Mr. J. M. Westgate, Agronomist in Charge of Clover Investigations, and has been submitted by Prof. C. V. Piper, Agrostologist in Charge of Forage-Crop Investigations, with a view to publication. It is expected that this bulletin will be followed soon by other bulletins, each treating of some particular phase of this important crop.

Respectfully,

WM. A. TAYLOR,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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CRIMSON CLOVER: GROWING THE CROP.

INTRODUCTION.

Probably the most important characteristic of crimson clover is its ability to grow and make its crop during the season when the land is not occupied by the ordinary summer-grown crops. In sections where it succeeds, crimson clover can be sown following a grain crop or in an intertilled crop in late summer and will mature a hay crop the following spring in time to plow the land for spring-seeded crops, such as corn or cotton. It may even be held for seed as far north as central Delaware and the stubble be plowed under in time for seeding the quick-maturing strains of corn. It may be turned under for soil improvement when only 6 inches high if it is desired to fit the land for early spring-seeded crops. Even if only the stubble be turned under, the effect upon the succeeding crop will be marked, especially if the soil be deficient in nitrogenous fertilizers. The plowing under of the entire plant, however, will more rapidly correct any deficiency of nitrates or humus in the soil. It is one of the best cover crops for use in orchards and, in fact, under any conditions where the soil is likely to wash during the winter months. The many uses to which this crop may be put merit a careful study of the best methods of establishing a stand of crimson clover upon a farm.

HISTORY AND PRESENT DISTRIBUTION OF CRIMSON CLOVER.

Crimson clover (fig. 1) is frequently called "Scarlet clover" and, somewhat less commonly, "German clover," "Italian clover," "French clover," "Incarnate clover," "Annual clover," etc. It occurs wild in England and in eastern and southern Europe and is grown as a forage and soil-improving crop in Italy, France, Germany, Austria, and Great Britain. It was introduced into this country as early as 1822, but was grown only to a very limited extent until about 1880. It has proved especially adapted to the lighter, sandy soils of the eastern part of the United States where the winters are not too severe.

In the Middle Atlantic States it is also grown to a considerable extent on the clay soils of the Piedmont section.

In Michigan it is sometimes used on the sandy soils as a cover crop in peach orchards, although it frequently winterkills. It can not ordinarily survive the severe winters of the Northern States.¹

¹ In such northern sections where a fall-seeded legume is desired it is suggested that hairy vetch seeded with rye be used instead. See Farmers' Bulletin 515, entitled "Vetches."

Crimson clover is a "winter annual," that is, it ordinarily makes its early growth in the autumn, passes the winter in a somewhat dormant but green state, makes a very early spring growth, and matures

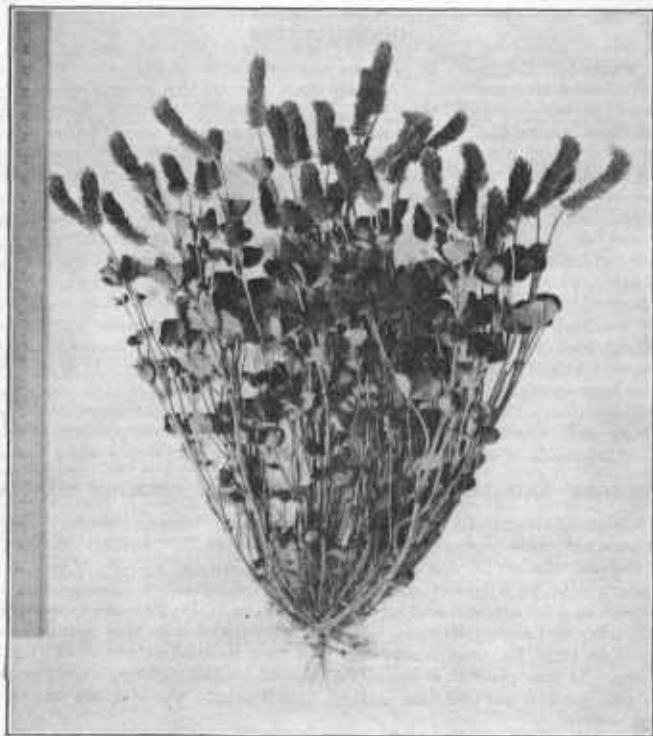


FIG. 1.—A single plant of crimson clover.

its seed and dies before summer. It makes little or no growth in very hot weather and therefore should not be sown in the spring, except in the extreme North, where it may make a satisfactory growth by autumn, so that a hay crop may be taken from it at that time.

REQUIREMENTS FOR OBTAINING AND MAINTAINING A STAND OF CRIMSON CLOVER.

Unless the conditions of soil and moisture are exactly right it is not an easy matter to establish a satisfactory stand of crimson clover, even in the sections where it is most extensively produced. (Fig. 2.) The lack of timely rains in late summer is responsible for most of the failures to obtain a satisfactory stand. The young seedlings are very easily killed by the hot sun or lack of moisture. On the other hand, if the seeding be delayed too long, as, for instance, in waiting for the proper conditions of soil moisture, the plants will be unable to make sufficient growth to withstand the winter. Briefly speaking, crimson clover should be seeded shallow on a moist, reasonably fertile, well-drained, well-settled seed bed. Inoculation in some form should be provided, especially when seeding it for the first time on any fields in sections comparatively new to this crop.



FIG. 2.—A crimson-clover failure on ground too poor in humus.

Crimson clover is not adapted to the white-clay lands in their present condition in some portions of the Atlantic Coastal Plain. Such fields should be seeded to soy beans or cowpeas when a leguminous crop is desired for soil improvement or other purposes.¹ Crim-

¹ These white-clay soils are nearly always sour, deficient in humus, and poorly drained. If limed, subsoiled, drained, and supplied with humus, such soils are said to grow crimson clover satisfactorily.

son clover does not do well on rough, newly cleared land and it ordinarily requires the production of two or three crops or a special preparation by liming, manuring, and inoculating before such land presents conditions satisfactory for seeding. It is usually better to sow rye for a winter cover and cowpeas for a summer crop if a cover crop is thought to be needed. In any section where crimson clover has not been previously grown the first seeding should be on a small scale to determine whether or not it is a practicable crop for the locality in question.

PREPARATION OF THE SEED BED.

The seed bed for crimson clover should be firm, moist, well settled, and fine on top. Any efforts that may be expended to conserve the soil moisture previous to seeding are usually justified, especially if there be any lack of rainfall during the month previous or the month following seeding. Where the clover is seeded in an intertilled crop, such as corn, cotton, or tomatoes, the customary cultivation received by these crops is ordinarily sufficient for the needs of crimson clover. Where grain-stubble land is plowed in preparation for the clover a month or six weeks are ordinarily required for the soil to settle sufficiently to make a proper seed bed, since after plowing at least one soaking rain, which compacts the soil and fills it with moisture, is essential to the proper preparation of the seed bed for crimson clover. If the ground be disked, a much shorter time and less rain are required for the proper settling of the seed bed. The best method of retaining the moisture in the seed bed is to harrow or give shallow cultivation shortly after each rain. A fine soil mulch on the surface will largely prevent the soil just beneath the surface from losing its moisture through evaporation. Such surface tillage should, of course, be given before seeding the crimson clover.

FERTILIZERS FOR CRIMSON CLOVER.

Under the ordinary conditions of soil fertility the fertilizer applied to the preceding crop is sufficient for the needs of crimson clover. This is especially true where the clover follows such crops as potatoes or tomatoes, which are ordinarily heavily treated with fertilizers that are not entirely used up by these crops. It is important to realize, however, that crimson clover has a very short period of growth and that to make a vigorous growth it must have a good supply of plant food. On sandy soils where there has been no recent application of fertilizers it is often the practice to apply from 200 to 400 pounds of a mixture of equal parts of acid phosphate and kainite. On clay soils 300 or 400 pounds per acre of acid phosphate are ordinarily sufficient. If the soil be low in nitrates a light application of nitrate of soda will assist materially in giving the young clover plants a good start and

often enable them to withstand the effects of a late drought or severe winter which otherwise might have proved fatal to the stand. If the seeding has been delayed, as by waiting for suitable rains, an application of nitrate fertilizer will stimulate the young plants and enable them to make an increased growth before winter.

Any direct application of fertilizer is usually made at seeding time, but some few farmers have been found who apply it as a top dressing very early the following spring, giving as a reason that there is no loss from winter leaching and that the plants are by this method nourished at the time they are making their most vigorous growth. Such top dressings of fertilizer should not be made while the leaves are wet with rain or dew. Where stable manure is applied to crimson clover very marked results follow. It may be spread just before seeding, when the clover is not grown in an intertilled crop, or it may be applied as a top dressing in winter or very early spring.

The more vigorous the growth that can be induced by the application of suitable fertilizers the more marked will be the increase in the yield of the succeeding crops. On soil not well supplied with humus or plant food the use of a reasonable amount of fertilizer will often enable a successful crop of clover and succeeding crops to be produced where, had not the fertilizers been applied, the clover would have failed. Furthermore, the following crop, particularly if it be corn, would also fail to give the increased yield which follows a successful stand of crimson clover.

An application of barnyard manure will be found to be especially effective in obtaining a stand of crimson clover on any thin, galled spots in the field. The manure should be worked into the ground and, if possible, a second application as a top dressing should be given such thin places to partially shade the ground from the August sun while the seedlings are establishing themselves.

LIMING SOILS FOR CRIMSON CLOVER.

Most of the soils in the crimson-clover sections will be found to be benefited by liming. Crimson clover, however, does not appear to require lime to the extent that red clover does. Frequently on well-drained soils in a good state of fertility the crimson clover makes a vigorous growth without the use of lime. The stands are, however, usually more uniformly good over the limed parts of such fields than on the parts that have received no lime. The opinion among individual farmers appears to be about equally divided as to whether or not it pays them to lime their soils for crimson clover. In considering the advisability of applying lime one must not lose sight of the need of lime on the part of such other crops as cantaloupes or peaches, which require lime and which are either grown with the clover or follow it. Inasmuch as the extent of the benefit

is somewhat uncertain it is suggested that the particular requirements of the farm in question be determined by liming small plats at different rates before any considerable areas are limed. The most profitable rate of application can then be adopted for the whole acreage.

INOCULATION FOR CRIMSON CLOVER.

Fortunately most of the soils in the crimson-clover sections appear to be already inoculated. This is especially true in sandy soil areas where crimson clover has been grown for a number of seasons. In sections new to this crop inoculation in some form is usually necessary. On clay soils inoculation is not always present, even though crimson clover may have been grown for a number of successive seasons on other fields of the farm.

An experiment conducted by the Alabama State Agricultural Experiment Station shows how essential inoculation is on soils which have not previously grown crimson clover. In this experiment a yield of 4,037 pounds of crimson clover hay was secured where the plants were inoculated, as compared with only 761 pounds where no inoculation was provided. In another test by the same station the inoculated plat of crimson clover yielded at the rate of 6,100 pounds of cured hay per acre, while the uninoculated plat was a total failure.

Inoculation by the use of soil from a crimson-clover field is considerably more certain than is inoculation by the use of pure cultures, but soil inoculation is open to the danger of introducing noxious weeds, insects, and plant diseases, especially if the soil is brought from a distance. There is much less danger in this respect if soil from inoculated plants can be obtained in the same neighborhood. One very practicable method is to apply a bottle of pure culture¹ to a pound or two of the seed and sow this in the corner of some field, or even in the garden. The resulting plants will be quite sure to be inoculated and will furnish an abundant supply of soil for inoculating much larger areas at the next seeding. Care must be taken not to allow the sun to shine upon either the pure cultures or the soil, or even on the seed after it is broadcasted. For this reason it is safest to seed on a cloudy day or after sundown. One very satisfactory method of soil inoculation consists merely in mixing together equal parts of the proper soil and seed and sowing immediately in front of the covering harrow.

SEEDING CRIMSON CLOVER.

Crimson clover may be sown broadcast, by hand, with a wheelbarrow "sheep-trough" seeder, or with any of the familiar types of

¹ Pure cultures are sent free by the U. S. Department of Agriculture. Full instructions for using them accompany each bottle.

rotary seeders. It is sometimes drilled in and there are a number of specially constructed drills designed for this purpose.

The consensus of opinion among farmers is that shallow seeding is generally best, especially upon the clay soils. An inch in sandy soils and half an inch in clay soils appears to be about the right depth except in times of drought.

The ordinary rate of seeding is 15 pounds per acre, although some use 20 pounds, while others are able to obtain satisfactory stands with only 12 pounds per acre. One pound of seed per acre provides for three seeds for every square foot; hence, if every seed produced a plant, 2 pounds per acre would be theoretically sufficient to secure a satisfactory stand. Under ordinary circumstances, however, it is necessary to allow for some of the seed being covered too deep, while a considerable proportion may prove to be covered too shallow for successful growth. The principal justification of seeding such a quantity and at varying depths lies in the fact that in case a dry season develops after seeding the more deeply covered seeds will be able to withstand the drought better than those covered to a medium depth. If an unusually wet season develops, the shallow-planted seeds will give the best results. Moreover, some of the seed will fail to germinate. It is also well to have a fairly thick stand of the young plants, so that the ground may be well covered even during early fall, and thus prevent the winter-growing weeds from establishing themselves.

It is held by many farmers that they are more certain of getting a stand of crimson clover if they sow the seed in the hull rather than use the hulled seed as it ordinarily appears on the market. It is claimed that the hulls hold the moisture to some extent. Seed in the hull can easily be obtained by flailing out a load of crimson clover which has been left uncut in the field until the seed is mature. Many farmers run the clover through an ordinary grain thrasher, which delivers the seed in the hull.

VARIOUS METHODS OF SEEDING CRIMSON CLOVER.

Crimson clover may be seeded in late summer in any of the ordinary intertilled crops. It may be seeded alone following any farm crop which can be removed from the land by early summer, so that the seed can be sown in late summer or very early fall. It may also be seeded for hay in mixture with grain, such as wheat, rye, barley, or winter oats, which are ready to cut for hay at about the same time as the clover the following spring. A very light seeding of an annual catch crop, such as buckwheat, may be made with crimson clover in time for the catch crop to make its growth before winter.

SEEDING CRIMSON CLOVER IN INTERTILLED CROPS.

Although crimson clover may be seeded in almost any of the intertilled crops, in this country probably half of it is sown in corn at or shortly after the time of the last cultivation. (Fig. 3.) It is usually possible to make such a seeding, obtain a good growth during the fall and early spring, and mature a crop of hay in time for breaking up the land for another crop of corn. South of the latitude of central Delaware it is even possible to mature a crop of clover seed in time for corn planting. In this way it is possible to grow a crop of corn each year and at the same time steadily increase the fertility of the soil for a series of years. Treated in this manner each succeeding crop of corn can ordinarily be materially increased. Instances are reported where



FIG. 3.—Seeding crimson clover in corn at the last cultivation.

the yield of corn has been gradually increased by this means from 10 bushels per acre at the start until as high as 70 bushels per acre were secured.

The newly seeded stands of clover in corn are likely to perish if drought occurs at or after seeding time. The growing corn makes heavy demands on the soil moisture, and if there is not enough moisture for both clover and corn the latter gets the larger share and the tender clover plants are likely to succumb. It sometimes happens that a very light rain shortly after seeding the clover will cause the seeds to germinate, only to perish during the succeeding days of dry weather. On account of the competition for moisture between the corn and clover it is best to cover the clover seed a little deeper than is necessary when it is sown on fallow land.

North of the Potomac River the last cultivation of the corn comes at about the right time for the best results with clover seeded at the same time. Farther south, however, there is too much hot weather after the corn is laid by, and as a consequence it is best to delay the seeding of the crimson clover until about 8 or 10 weeks before the first frost may be expected. A light narrow-toothed cultivator or harrow may be run shallow between the rows to cover the seed. The seed may be sown broadcast by hand or even from horseback with a rotary seeder. In such an event, however, it is necessary to cover the ears of the horse with small bags or socks to prevent the entrance of the flying seed. A much more even stand is made possible if the corn is given level tillage rather than the ridged tillage incident

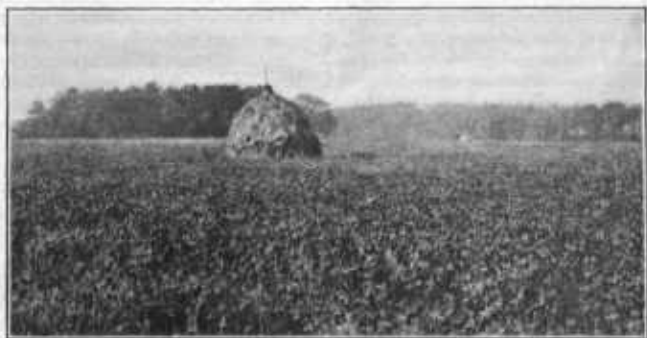


FIG. 4.—Crimson clover in an old cornfield. The clover was seeded in the corn at the last cultivation. A fodder stack is to be observed in the middle foreground. The cornstalks have been removed to avoid difficulty in mowing the clover.

to plowing with a 1-horse corn plow and ridging the land. The appearance of a field of crimson clover seeded the summer previous in corn is indicated in figure 4.

In North Carolina and southern Virginia it has been found possible under favorable conditions to obtain a satisfactory stand of clover by seeding in cotton. The clover should not be sown until 10 or 12 weeks before frost and the last working of the cotton comes ordinarily at an earlier date than this. It is necessary that the cotton be given very clean culture, as well as special attention paid to conserving the moisture in the prospective clover-seed bed. Unless the first show of cotton is picked early it is difficult to cover the clover seed without unduly injuring the opened cotton bolls. In the higher and more

northern parts of the cotton belt it is possible to make the clover seeding before the bolls begin to burst.

Crimson clover may be seeded in practically any of the cultivated truck crops which receive their last cultivation from 8 to 12 weeks before the first frost. It is not practicable to seed the clover in late potatoes, as the digging of the potatoes in the fall practically destroys the stand of clover. The heavy application of fertilizers necessary for the truck crops makes possible a vigorous growth of the clover. The result is that the soil is materially built up in both nitrogen and humus. The clover makes its growth at a season of the year when the land is not ordinarily occupied by any of the regular truck crops.

When timely rains follow the seeding it is possible to seed the clover on the surface of the ground among cantaloupe vines and allow the first rain to cover the seed. The shade is apparently too dense under watermelon vines for the clover seedlings to survive. The writer has obtained a good stand by seeding the clover seed, without covering, in sweet potatoes the first week in August on sandy land near Washington, D. C. By hand-digging the potatoes with a spade a fair stand of the clover plants was left unharmed.

SEEDING CRIMSON CLOVER AFTER EARLY-MATURING CROPS.

It is possible to seed crimson clover after practically any of the ordinary farm crops which can be removed from the land three months before frost.

It is somewhat difficult to obtain anything like an ideal seed bed for crimson clover where a field of grain stubble has been plowed under. The soil in a stubble field is apt to be dry and cloddy when plowed, while the stubble tends to form a dry mat at the bottom of each furrow. Such a condition is likely to continue for a number of weeks after plowing and to result disastrously to the clover seedlings unless there be abundant and frequent rains. It is ordinarily a better practice to disk the grain stubble and harrow every week, or at least after every rain, in order to settle the ground and assist in holding the moisture pending the time of seeding. Such frequent harrowings will also kill the successive crops of germinating weed seeds, which might otherwise injure the young stand of clover.

On the other hand, the ground from which early potatoes have been removed is very favorable for the establishment of a stand of crimson clover. The residual effect of the fertilizers used on the potatoes is partially responsible for this, while the well-settled seed bed, which requires only leveling and harrowing, also presents favorable conditions for the crimson-clover seedlings.

SEEDING CRIMSON CLOVER WITH LATE SUMMER-SEEDED ANNUAL CROPS.

Crimson clover may be seeded in midsummer or in late summer with a very light seeding of buckwheat. The buckwheat soon forms an ideal shade for the young clover plants and unless frosts occur very early a crop of buckwheat may usually be harvested. This method has been suggested as being applicable when seeding the clover in cotton. If the buckwheat is not seeded until August it will not ordinarily produce seed in the latitude of Washington, D. C. Wherever possible, the seeding of buckwheat and crimson clover should be made so early that there will be time for the buckwheat to mature its seed crop, as in this way the buckwheat itself will pay for the expense of starting both stands. A light seeding of the buckwheat must be made, as an ordinary stand of buckwheat shades the ground so completely as to destroy the crimson clover.

Another method of preventing the injurious effect of the hot sun of late summer is to make a light seeding of cowpeas at the same time that the crimson clover is seeded. The cowpeas germinate promptly, and being rather thin on the ground do not injure the stand of clover, but on the contrary afford sufficient shade to prevent the soil from becoming as hot as it otherwise would. In addition, the clover plants receive some protection from the direct rays of the sun. There is ordinarily not enough time for the cowpeas to mature, so they are either mown for hay or left standing to catch the snow during the winter and protect the stand of clover. In seedings made by the writer half a bushel of cowpeas per acre, broadcasted, gave very satisfactory results, the seeding being made August 1 on sandy ground near Washington, D. C. The clover and cowpeas were sown broadcast on early-potato ground and covered from one-half to 1 inch deep.

If a light seeding of turnips be made with the clover, the turnip plants will afford some protection to the young clover plants and at the same time will ordinarily yield a fair crop of turnips. About 1 pound of turnip seed and 15 pounds of clover seed should be sown to the acre. If the seeding of turnips be at all heavy the coarse-growing turnip plants will choke out too many of the clover plants. The Cow Horn turnips appear to be especially adapted for seeding with crimson clover.

CRIMSON CLOVER IN MIXTURES WITH OTHER LEGUMES AND GRAIN.

When crimson clover is seeded alone on good soil it is likely to make so rank a growth as to lodge. To overcome this difficulty it is a common practice to seed some small-grain crop with the clover at seeding time. South of the Potomac River winter oats are ordinarily very

satisfactory, especially when seeded with the late white-blooming strain of crimson clover. In Delaware and eastern Maryland wheat is commonly used. In addition to wheat and oats, rye or barley is sometimes used.



FIG. 5.—Crimson clover and wheat in mixture. In the foreground the crop has been cut and fed green to stock. The remainder was cut the next day for hay. The grain prevents the crimson clover from lodging.

The customary rate of seeding is about 15 pounds of clover seed and 30 pounds of grain per acre. The accompanying illustration (fig. 5) indicates the appearance of a field seeded to a mixture of crimson clover and wheat. The grain prevents the clover from lodging, facilitates the curing of the clover hay, and, in addition, forms a valuable constituent of the resulting hay crop. The yield of the mixture is ordinarily somewhat more than when the clover is seeded alone. The Alabama State Agricultural Experiment Station secured as

the average for two years' experiments the following yields of hay:

	Yield per acre.
Crimson clover seeded alone.....	2, 836 pounds.
Crimson clover seeded in mixtures:	
Barley and crimson clover.....	3, 695 pounds.
Wheat and crimson clover.....	3, 771 pounds.
Oats and crimson clover.....	4, 228 pounds.

The grain is usually well headed but is in the milk or soft-dough stage when the clover is ready to cut. The presence of the grain hay makes the clover hay more easily cured. With winter oats it is usually best to seed the late white-blooming variety of crimson clover, as the oat crop matures somewhat later than the ordinary crimson clover. Another advantage of this mixture is that if either should fail the

other will be present to serve as a cover crop during winter and bring some return the following spring.

Crimson clover may be seeded in mixtures with vetch, shaftal clover, trefoil, or, in fact, any winter-growing legume which has a growing season similar to crimson clover. Since most of these legumes are not upright in their growth it is usually necessary to seed some grain crop with them to serve as a support and to prevent the plants from lodging. The grain is ordinarily a surer crop than the legumes and practically insures the ground being covered with some crop during the winter and spring months.

SEEDING CRIMSON CLOVER ALONE.

If a good seed bed can be prepared by August 1 in the latitude of Washington, D. C., crimson clover will ordinarily produce a satisfactory stand if seeded entirely alone. This is especially true on the clay soils, where it is often difficult to obtain a successful catch in corn at the last working. The seed is sown at the same rate as when seeded in corn, namely, about 15 pounds per acre. It is the common practice to broadcast the seed and to cover with a very light harrow or weeder. Unless the August sun be unduly hot and a drought develops, such seeding will ordinarily produce very satisfactory results if the soil be reasonably fertile.

TREATMENT OF CRIMSON CLOVER STANDS AFTER SEEDING.

Ordinarily no special treatment is required after seeding, and before winter comes on some fall pasturage may be obtained if the growth be sufficiently rank. A light pasturing with sheep has been noted to induce heavier stooling on the part of the crimson clover. Only a light pasturing with small animals, such as sheep, calves, or chickens, should be made in either the fall or spring before the early spring growth is well under way. If the time of seeding has been delayed, or if for any reason it is feared that the plants will be unable to make sufficient growth before cold weather, it has been found that a top dressing of nitrate of soda alone or in mixture with muriate of potash will greatly hasten the fall growth. This reduces the danger from winterkilling and heaving out in the early spring.